

**WHAT IS CLAIMED IS:**

- 1     1.     An internal combustion engine, comprising:
  - 2             a cylinder head defining an intake port leading to a
  - 3     cylinder of the engine;
  - 4             an intake valve located at a downstream end of the
  - 5     intake port;
  - 6             a flow regulating section to regulate an intake air
  - 7     flow in the intake port, the flow regulating section
  - 8     including;
  - 9             a partition extending in the intake port in a
  - 10    longitudinal direction of the intake port from an upstream
  - 11    end to a downstream end which is located in the cylinder
  - 12    head, and dividing the intake port into first and second
  - 13    passage sections;
  - 14             a gas motion control valve located by the upstream
  - 15    end of the partition, to open and close the second passage
  - 16    section; and
  - 17             a connection passage to allow recirculating flow of
  - 18    intake air in the second passage section from the second
  - 19    passage section to the first passage section when the
  - 20    second passage section is closed by the gas motion control
  - 21    valve; and
  - 22             a fuel injector directed to inject fuel toward a valve
  - 23    opening of the intake valve through a space on the
  - 24    downstream side of the downstream end of the partition.
- 1     2.     The internal combustion engine as claimed in Claim 1,
- 2     wherein the fuel injector is directed to cast a fuel spray
- 3     across an imaginary extension of the partition toward the
- 4     valve opening of the intake valve, without impinging on the

5 partition, through the space on the downstream side of the  
6 downstream end of the partition.

1 3. The internal combustion engine as claimed in Claim 1,  
2 wherein the downstream end of the partition is close to an  
3 outer boundary of the fuel spray produced by the fuel  
4 injector.

1 4. The internal combustion engine as claimed in Claim 1,  
2 wherein the fuel injector is disposed above the partition.

1 5. The internal combustion engine as claimed in Claim 1,  
2 wherein the fuel injector is received in a recess formed in  
3 the first passage section of the intake port.

1 6. The internal combustion engine as claimed in Claim 1,  
2 wherein the cylinder of the engine is provided with two of  
3 the intake valves, and the fuel injector is arranged to inject  
4 fuel to both of the valve openings of the intake valves of  
5 the cylinder.

1 7. The internal combustion engine as claimed in Claim 1,  
2 wherein the partition is formed with a groove extending in  
3 the longitudinal direction of the intake port.

1 8. The internal combustion engine as claimed in Claim 7,  
2 wherein the groove extends to the upstream end of the  
3 partition, and the connection passage is formed between  
4 the gas motion control valve and an upstream end of the  
5 groove.

1 9. The internal combustion engine as claimed in Claim 7,  
2 wherein the groove extends to the downstream end of the  
3 partition and a downstream end of the groove is so  
4 depressed as to avoid interference between a fuel spray  
5 produced by the fuel injector and the downstream end of  
6 the partition.

1 10. The internal combustion engine as claimed in Claim 9,  
2 wherein the downstream end of the groove is depressed so  
3 that a fuel spray from the fuel injector passes through a  
4 region within the groove at the downstream end of the  
5 partition.

1 11. The internal combustion engine as claimed in Claim 7,  
2 wherein the groove extends from the downstream end of  
3 the partition to the upstream end of the partition.

1 12. The internal combustion engine as claimed in Claim  
2 11, wherein a cross section of the groove is uniform from  
3 the downstream end of the partition to the upstream end of  
4 the partition.

1 13. The internal combustion engine as claimed in Claim 7,  
2 wherein the partition includes first and second side portions  
3 extending in the longitudinal direction of the intake port,  
4 and the groove is formed between the first and second side  
5 portions.

1 14. The internal combustion engine as claimed in Claim 7,  
2 wherein the groove is depressed toward the second  
3 passage section.

1 15. The internal combustion engine as claimed in Claim 7,  
2 wherein the partition is formed with a plurality of the  
3 grooves.

1 16. The internal combustion engine as claimed in Claim  
2 15, wherein the cylinder of the engine is provided with two  
3 of the intake valves; the fuel injector is arranged to  
4 produce two fuel sprays directed, respectively, to the valve  
5 openings of the intake valves of the cylinder; and the  
6 partition is formed with two of the grooves each of which is  
7 so depressed as to avoid interference between a unique one  
8 of the fuel sprays produced by the fuel injector and the  
9 downstream end of the partition.

1 17. The internal combustion engine as claimed in Claim 1,  
2 wherein the gas motion control valve comprises a valve  
3 shaft located on an imaginary upstream extension of the  
4 partition, and a valve element swingable on the valve shaft,  
5 between an open position at which the valve element  
6 extends continuously with the partition in the longitudinal  
7 direction of the intake port, and a closed position at which  
8 the valve element closes the second passage section, and  
9 inclines so as to guide an intake air stream from the  
10 upstream side, toward the first passage section.

1 18. The internal combustion engine as claimed in Claim 1,  
2 wherein the valve element of the gas motion control valve  
3 comprises a first valve portion closing the second passage  
4 section, and a second valve portion projecting in the first  
5 passage section when the second passage section is closed  
6 by the first valve portion.

1 19. The internal combustion engine as claimed in Claim  
2 18, wherein the second valve portion of the gas motion  
3 control valve closes the connection passage at least partly  
4 so as to reduce an opening area of the connection passage  
5 when the gas motion control valve(31) is in an open  
6 position opening the second passage section.

1 20. The internal combustion engine as claimed in Claim 1,  
2 wherein the second passage section is located below the  
3 first passage section in an up-down direction of the cylinder  
4 of the engine.

1 21. The internal combustion engine as claimed in Claim 1,  
2 wherein the gas motion control valve is arranged to reduce  
3 an open sectional area of the intake port to produce a low  
4 pressure region in the first passage section of the intake  
5 port; and the connection passage connects an upstream  
6 end portion of the second passage section to the low  
7 pressure region produced in the first passage section to  
8 promote recirculating flow of intake air in the second  
9 passage section from a downstream end of the second  
10 passage section to the upstream end portion of the second  
11 passage section, and from the upstream end portion to the

12 first passage section when the second passage section is  
13 closed by the gas motion control valve.

1 22. The internal combustion engine as claimed in Claim 1,  
2 wherein the connection passage is in the form of a slit  
3 elongated in a direction perpendicular to the longitudinal  
4 direction of the intake port.

1 23. The internal combustion engine as claimed in Claim 1,  
2 wherein the connection passage is in the form of an  
3 interspace between the upstream end of the partition and  
4 the gas motion control valve in a closed position closing the  
5 second passage section.

1 24. An intake apparatus for an internal combustion  
2 engine, comprising:  
3 first means for defining an intake port;  
4 second means for dividing the intake port into first  
5 and second passage sections extending in a longitudinal  
6 direction of the intake port;  
7 third means for closing an upstream end of the  
8 second passage section and forming a low pressure region  
9 in the first passage section;  
10 fourth means for drawing intake air from a  
11 downstream end of the second passage section through the  
12 second passage section to the low pressure region in the  
13 first passage section when the upstream end of the second  
14 passage section is closed; and  
15 fifth means for injecting fuel in an oblique direction  
16 extending from the first passage section to the second

- 17 passage section through a space between the partition and
- 18 the downstream end of the intake port.